

THE MINERAL INDUSTRY OF FINLAND

By Harold R. Newman

On January 1, 1995, Finland acceded to the European Union (EU). At that time, amendments to the Finnish Mining Law took effect and allowed any individual, corporation, or foundation having its principal place of business or central administration within the EU to enjoy the same rights to explore for and exploit mineral deposits as any Finnish citizen or corporation.

Mineral legislation and regulations are covered under the Mining Act (Kaivoslaki 503/65), the Mining Decree (Kaivosasetus 663/65), and Amendments to the Mining Law (1427/92, 1625/92, 474/94, 1571/94, 208/95, 561/95, and 1076/95). These are referred to collectively as the Mining Law. The minerals covered by the Mining Law include about 50 metals and 30 minerals, as well as gems, marble, and soapstone. (Kortman, Nurmi, and Vuotovesi, 1996).

Government involvement in the mineral industry was considerably higher than in any of the other EU countries. Government-owned companies, Finnminers Group (hard-rock drilling/loading and ore processing), Kemira Oy (chemicals), Outokumpu Oy (base metals and mining technology), and Rautauukki Oy (steel production) dominated the domestic mineral industry, while Government organizations, the State Geologic Research Institute, and the State Technological Research Center were active in exploration and research. Because of Outokumpu and Finnminers, Finland is a world leader in the technology of underground mining, ore processing, and metallurgy.

The country has well-established mining, mineral processing, and refining industries; however, the diminishing supply of indigenous metalliferous raw materials required most of the feed for smelters to be imported (100% of iron ore concentrate, 80% of zinc concentrate, and 60% of nickel matte and concentrate). There was a small increase in metallic ore production while output of industrial minerals remained fairly constant. (*See table 1.*)

The major mineral resources companies are shown in table 2. Outokumpu's Kemi Mine, the only chromite mine in Finland, was a significant chromite producer. By the end of 1996, about 20 million metric tons (Mt) of ore had been produced. Current output was around 1 million metric tons (Mt/yr).

Although it has no primary copper mines, Finland does produce copper as an associated mineral from Outokumpu's primary zinc mine at Pyhäsalmi. Outokumpu's blister copper capacity was 160,000 metric tons per year (t/yr), cathode copper capacity was 125,000 t/yr, and nickel capacity was 32,000 t/yr.

Terra Mining Oy started open pit gold operations at the Pahtavaara Mine in June 1996. Gold mineralization occurs

within a distinct talc-chlorite alteration zone which is up to 100 meters (m) wide and appears to be a typical splay structure related to a major east-west shear zone. Within this alteration zone, gold is present in quartz-barite vein zones up to 10 m wide. Geologically, the style of mineralization is very similar to shear zone-hosted gold deposits related to major breaks in the Canadian Shield (Williams Resources Inc., 1997, unpub. data, accessed February 20, 1997, on the World Wide Web at URL <http://www.info-mine.com/william.htm>).

Finland has never been a major gold producer, however, exploration for gold in 1996 was being conducted by several companies, domestic and foreign, as well as the Geological Survey of Finland (GSF). Activity was mainly centered on the Lapland Greenstone Belt, the Archean Greenstone Belts of eastern Finland and the Svecofennian Schist Belt in the south.

The only remaining domestic nickel mine in operation in 1996 was Outokumpu's Hitura Mine. The Enonkoshi Mine and the Vammala Mine were closed in 1994. Hitura has produced more than 8 Mt of ore grading 0.55% nickel and 0.20% copper since 1965.

All steel production in Finland was from imported concentrates and iron pellets. Two-thirds of the raw material came in the form of fines from Sweden's Luossavaara-Kiirunavaara AB. The balance came from Russia in the form of iron pellets from Kostamus and fines from Olenogorsk.

The sale of 26.5% of the Finnish government's 68.7% stake in the country's largest steelmaker, Rautaruukki Oy, has been successfully completed. SBC Warburg and Union Bank of Switzerland exercised their option to purchase 3.8 million shares in the company. This brings the total number of shares sold to institutional investors to 31.9 million plus 7.4 million shares sold to the general public. The selling price of the shares was \$8.30¹ per share; the capital raised will be used to complete the company's current investment program, including the upgrading of flat products operations. The Government was expected to keep its remaining holding of 42.3% in Rautaruukki for the foreseeable future (Metal Bulletin, 1997).

The only mine producing zinc in 1996 was Outokumpu's Pyhäsalami Mine at Pyhajarvi. The zinc concentrate was shipped to the Kokkola smelter, while the associated copper concentrate was shipped to the Harjavalta smelter. Pyhäsalami, together with Outokumpu's Tara Mine in Ireland, supplied about 80% of the feed for the Kokkola smelter.

¹Where necessary, values have been converted from Finnish markkas (Fm) to U.S. dollars at the rate of Fm 5.06=US\$1.00.

Malmikaivos Oy discovered a series of kimberlite bodies in northern Finland. Malmikaivos, a subsidiary of Ashton Mining of Australia, has discovered 30 kimberlite pipes, one-half of which were diamondiferous. Two pipes, which were closely studied, contained quantities of clear and colorless diamonds. A surface sample of 23 metric tons (t) was taken from a pipe with a two hectares (ha) area, which yielded 26 carats per 100 t (ct/100 t), mostly of good quality. Another pipe, slightly more than 1 ha, contained 13 to 26 ct/100 t based on a 9.4 t sample (Geological Survey of Finland, Diamond Exploration, March 25, 1997, accessed May 29, 1997 on the World Wide Web at URL <http://www.gsf.fi/explor/minfinl.htm>).

Several other companies, including RTZ Mining & Exploration Ltd., Finnsearch Oy, Conroy Plc. Of Ireland, and Baltic Minerals Finland Oy, were active in diamond exploration; none of the companies had issued any preliminary findings at yearend.

Finnminerals Oy was the largest producer of paper-grade talc in Europe and Finland's sole producer of talc. Previously part of the largest European paper conglomerate, UPM-Kymmene, Finnminerals was sold to Western Mining Corp. Holdings Ltd. of Australia (50%) and Plüss-Staufer AG of Switzerland (50%). The company also has talc slurry plants in the Netherlands and Sweden.

GSF has placed emphasis on exploration for pigment minerals, such as ilmenite, high quality carbonates, and kaolin. Also, a number of dimension stone deposits were being assessed by various companies.

Finland was one of the largest energy consumers in western Europe. Only about one-third of its energy requirements were satisfied by indigenous sources, namely, hydro and nuclear power, peat, and wood. All other energy sources, such as coal, natural gas, and petroleum were imported.

Finland was seeking to bring its two principal public energy companies, the oil and chemical group Neste and the electricity

company Imatran Voima (IVO), into a closer partnership, with a possible merger of the groups. IVO has already begun to prepare for the liberalization of the European energy market, taking over the Swedish company Gullspang Kraft in 1996 (Energy News, 1997).

The operating environment in Finland is generally favorable for exploration and mine development. The country has a long mining history and a traditional focus on primary resources such as mining, forestry, and farming. Finnish mining equipment manufacturers are recognized throughout the world's mining community. There is a well-developed infrastructure with good port facilities, an extensive high voltage power grid, and a comprehensive road network.

The GSF has identified a number of mineral deposits for which information is available. The likelihood of additional discoveries may be enhanced with the entrance of foreign companies into the Finnish mineral industry. Despite recent discoveries, the future of the Finnish mineral industry rests mainly on metallurgy.

References Cited

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- Kortman, C., Nurmi, P.A., and Vuotovesi, T., 1996, Introduction to mineral legislation in Finland. (2d ed.). Espoo; Geological Survey of Finland, 8 p.
- Metal Bulletin, 1997, Rautaruuki sell-off: Metal Bulletin, no. 8181, May 26, p. 30.

Major Source of Information

Geological Survey of Finland
Betoniemienkuja 4
02150 Espoo
Finland

TABLE 1
FINLAND: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1992	1993	1994	1995	1996 e/
METALS					
Aluminum metal, secondary	27,300	29,900	35,466	35,090 r/	31,000
Cadmium metal, refined	590	785	548 r/	539 r/	648 2/
Chromite:					
Gross weight:					
Lump ore e/ thousand tons	250	191	225	214 r/	210
Concentrate e/ do.	229	300	341	373 r/	360
Foundry sand e/ do.	20	20	7	11 r/	12
Total do.	499	511	573	598	582 2/
Cr2O3 content:					
Lump ore e/ do.	54	45	76	80	70
Concentrate do.	130	170	150	150	150
Foundry sand e/ do.	3	3	3	3	3
Total do.	187	218	229	233	223
Cobalt, metal, powder, and salts	2,100	2,150	1,443 r/	1,709 r/	1,800
Copper:					
Concentrate, gross weight	37,397	44,154	34,410	26,000 r/	24,000
Mine output, Cu content	10,246	11,131	13,243	9,790 r/	9,300
Metal:					
Smelter	110,502	107,201	129,265	120,577 r/	135,400 2/
Refined	70,948	73,373	69,177	73,700 r/	110,700 2/
Gold metal kilograms	1,559	1,385	1,372	2,061 r/	3,100
Iron and steel, metal:					
Pig iron thousand tons	2,452	2,535	2,597	2,242 r/	2,457 2/
Ferroalloys, ferrochromium do.	187	218	254	247 r/	236 2/
Steel, crude do.	3,076	3,255	3,419	3,176	3,301 2/
Seminufactures, rolled do.	2,300 e/	2,300 e/	3,121	3,242	3,272 2/
Lead, mine output, Pb content	576	--	--	--	--
Mercury	85	98	83	90	88 2/
Nickel:					
Concentrate, gross weight	135,200	127,400	107,865	110,000 e/	125,000
Mine output, Ni content	9,270	8,290	7,652	3,439 r/	3,900
Metal, electrolytic	14,781	14,777	16,902	16,070 r/	15,200 2/
Platinum-group metals:					
Palladium kilograms	100 e/	100 e/	96	95 r/	90
Platinum do.	269	--	37	37 r/	36
Selenium metal do.	30,000	30,400	30,000 r/	29,690 r/	27,000
Silver metal do.	27,168	15,896	25,000 r/	26,098 r/	34,000
Zinc:					
Concentrate, gross weight	59,500	42,400	41,971	43,000 r/	58,000
Mine output, Zn content	32,817	22,529	16,916	16,385 r/	25,700
Metal	170,523	170,934	173,200	176,600 r/	176,300
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	1,129	835	864	907 r/	947 2/
Feldspar	47,470	51,477	43,483	41,808 r/	42,000
Lime thousand tons	241	250 e/	321	401 r/	400
Mica	5,134	4,488	5,591	-- r/	--
Nitrogen, N content of ammonia	10,000 e/	10,000 e/	11,894	5,933 r/	6,000
Phosphate rock, apatite concentrate:					
Gross weight thousand tons	555	628	657	671 r/	600
P2O5 content do.	201	227	236	243 r/	225
Pyrite, gross weight do.	653	691	839	829 r/	869 2/
Sodium sulfate do.	30 e/	30 e/	36	34 r/	36 2/
Stone, crushed:					
Limestone and dolomite:					
For cement manufacture thousand tons	1,554	1,005	1,047	1,114 r/	1,100
For agriculture do.	796	1,035	898	787 r/	800
For lime manufacture do.	364	348	343	335 r/	350
Fine powders do.	475	568	382	316 r/	300
Metallurgical e/ do.	2	2	2	2	2
Total do.	3,191	2,958	2,672	2,554 r/	2,552
Quartz silica sand do.	169	167	71	30 r/	35
Soapstone do.	28	27	29	31 r/	--

See footnotes at end of table.

TABLE 1-Continued
FINLAND: PRODUCTION OF MINERAL COMMODITIES1/

(Metric tons unless otherwise specified)

Commodity	1992	1993	1994	1995	1996 e/	
INDUSTRIAL MINERALS--Continued						
Sulfur:						
S content of pyrite	do.	293 r/	292 r/	369 r/	422 r/	425
Byproduct:	do.					
Of metallurgy	do.	225	225 e/	--	--	--
Of petroleum	do.	32 e/	32 e/	41	37 r/	38 2/
Total	do.	550 r/ e/	549 r/ e/	410 r/	459 r/	463
Sulfuric acid	do.	1,320	1,300 e/	1,084	1,159 r/	1,200
Talc	do.	371	399	453 r/	464 r/	419 2/
Wollastonite		27,842	26,796	27,757	29,592 r/	22,304 2/
MINERAL FUELS AND RELATED MATERIALS						
Peat:						
For fuel use	thousand tons	5,103	3,945	4,000 e/	5,000	4,500
For agriculture and other uses	do.	355	350	550 e/	500	500
Petroleum refinery products	thousand 42-gallon barrels	73,000 e/	76,000 e/	80,486	78,000 r/	78,000

e/ Estimated. r/ Revised.

1/ Table includes data available through May 1997.

2/ Reported figure.

TABLE 2
FINLAND: STRUCTURE OF THE MINERAL INDUSTRY FOR 1996

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Ammonia	Kemira Oy (Government 98%)	Plant at Oulu	75
Cadmium, metal	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Smelter at Kokkola	1
Cement	Partek Cement Oy (Partek Corp. 50% and Metra Corp. 50%)	Plants at Lappeenranta and Pargas	1,200
Chromite	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mine at Kemi	730
Copper:			
Ore, Cu content	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mines at Pyhäsalmi, Saattopora, and Hitura	10
Metal	do.	Smelters at Harjavalta and Pori	160
Feldspar	Lohja Oy (Metra Corp. 100%)	Mines and plants at Haapaluoma, Kemio, and Peraseinjok	50
Ferrochrome	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Smelter at Tornio	230
Gold:			
Ore, Au content	tons do.	Mines at Orivesi and Saattopora	4
Metal	do.	Smelter at Pori	4
Limestone	Partek Minerals Oy (Partek Corp. 100%)	Mines at Kolari, Lappeenranta, and Pargas	1,900
Do.	Lohja Oy (Euroc, 100%)	Mines at Mustio and Sipoo	1,650
Do.	Rauma-Repola Oy	Mine at Turnio	300
Mercury	tons Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Smelter at Kokkola	150
Mica	Kemira Oy (Government 98%)	Mine at Siilinjärvi	10
Nickel:			
Ore, Ni content	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mine at Hitura	3
Metal	do.	Smelter at Harjavalta	32
Phosphate-apatite	Kemira Oy (Government 98%)	Mine at Siilinjärvi	700
	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mine at Pyhäsalmi	800
Quartz and quartzite	Lohja Oy (Euroc, 100%)	Mines at Kemio and Nilsia	250
Selenium	tons Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Smelter at Pori	35
Silver	do.	do.	30
Steel	Rautaruukki Oy (Government 42.3%)	Plant at Raahe	2,100
Do.	Fundia AB (Norsk Jenverk AS of Norway 50% and Rautaruukki 50%)	Plants at Aminnefors, Dalsbruk, and Koverhar	850
Do.	Ovako Oy (SKF 50%, Wartsila 25%, and Fiskas 20%)	Plant at Imatra	600
Talc	Finnminerals Oy (United Paper Mills 100%)	Mines at Lahnaslampi, Lipsavaara, Luikanlahti, and Poljivari	500
Wollastonite	Partek Minerals Oy (Partek Corp. 100%)	Mine at Lappeenranta	30
Zinc:			
Ore, Zn content	Outokumpu Oy (Government 40% and Insurance Co. 12.3%)	Mines at Pyhäsalmi and Mullikkoräme	25
Metal	do.	Smelter at Kokkola	175